

**REMARKS**

Claims 1 and 15-24 are pending in the present application. By this Amendment, claims 1 and 15-24 have been amended. No new matter has been added. It is respectfully submitted that this Amendment is fully responsive to the Office Action dated March 15, 2006.

**Allowable Claim Subject Matter:**

Applicant gratefully acknowledges the indication in page 17 of the Action claims 17 and 18 would be allowable if amended into independent form and to overcome the rejection under 35 USC 112, second paragraph, as indicated in page 17 of the Action.

However, for at least the reasons discussed below, it is respectfully submitted that all of claims 1 and 15-24 are allowable.

**New Matter:**

The examiner submits that the use of an optical balanced homodyne detector was not disclosed, inherently or otherwise, by the originally filed application since a different type of detector could have been used (i.e. heterodyne detectors), thus the amendments by applicant concerning the use of an optical balanced homodyne detector is considered new matter. As per 37 CFR 1.53(b), applicant's amendments may not introduce new matter into an application after its filing date.

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This rejection is respectfully traversed.

It is submitted that the abstract, specification and claim 1 have been amended such that the reference to the new matter i.e., optical balanced homodyne detector has been deleted. Accordingly, withdrawal of this rejection is respectfully requested.

**35 USC 112, Second Paragraph Rejection:**

Claims 1 and 15-24 stand rejected under 35 USC 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

This rejection is respectfully traversed.

With regard to items 1- 7 and 9 -16, it is respectfully submitted that the claims have been amended to overcome these aspects of the rejection.

With regard to item 8, it is respectfully submitted that the Examiner's position is unreasonable, since the feature of claim 15 recited on after line 23 is similar to BB84 protocol described in the cited reference W, but the present invention differs from BB84 protocol in the method of detecting the information. The reference uses a single photon counter, whereas the

present invention uses a quadrature amplitude measuring apparatus. The output signal of the quadrature amplitude measuring apparatus is a real numerical value which varies continuously, then, in the protocol of the present invention, after measuring the output signal of the quadrature amplitude measuring apparatus, it is essential to compare the output signal which the threshold values in order to determine whether the output signal is bit 1 or 0. Reciting the difference between the protocol of the present invention and BB84 protocol clearly in the claim 15, it is necessary to describe as the feature of claim 15 recited on after 23.

Accordingly, with regard to item 8, it is respectfully submitted that the features of claim 15 recited on and after line 23 are directed to aspects of the present invention and are not merely an intended use. As such, it is submitted that the Examiner must afford proper patentable weight to such features.

In view of the above-note arguments and amendments, withdrawal of the rejection is respectfully requested.

**As to the Merits:**

As to the merits of this case, the Examiner sets forth the following rejections:

1) Claims 1, 15, 16 and 24 stand rejected under 35 USC 103(a) as being unpatentable over Bennett (USP 5,307,410) in view of Kahn et al. (USP 5,007,106);

2) Claims 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bennett in view of Kahn et al. and further in view of Bethune et al. (USp 6,188,768);

3) Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bennett in view of Kahn et al. and further in view of Bartelt et al. ("The Wigner Distribution Function-An Alternative Signal Representation in Optics"); and

4) Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bennett in view of Kahn et al. and further in view of Lee (USP 5,665,423).

Each of these rejections are respectfully traversed.

Independent claim 1 calls for *wherein an eavesdropping is detected by said recipient measuring a change in a quantum-mechanical probability distribution of said difference signal, which is produced by the eavesdropping operation.*

The Examiner asserts in item 3 of page 10 of the Action that Bennett discloses:

[w]herein an eavesdropping is detected by the recipient measuring a change in said quantum-mechanical probability distribution of said difference signal, which is produced by the eavesdropping operation (col 7, lines 37-43 and col 9, lines 48-60).

However, according to col. 7, lines 37-42 of Bennett:

The twice-delayed LL pulse is brighter by a factor approximately  $R^2$  than the SL+ LS pulse. Although the LL pulse contains no phase information, it is still valuable because its arrival, at the correct time and with the correct intensity, can be monitored by the photodetector 84 to guard against a type of active eavesdropping “selective pulse suppression”.

In view of the above disclosure, it is clear that the LL pulse, whose arrival and intensity can be used to monitor the activity of an eavesdropper, contains no phase information. As such, it is respectfully submitted that Bennett fails to detect an eavesdropping by measuring a change in a quantum-mechanical probability distribution of the difference signal, since the difference signal is detected based on the phase difference between a weak signal light and an intense reference signal, as called for in claim 1.

In other words, while Bennett may disclose that active eavesdropping can be monitored based on the timing and intensity of the LL pulse, the LL pulse fails to constitute a difference signal as set forth in claim 1, since, as noted above, it contains no phase information.

Moreover, it is submitted that the secondary reference of Khan fails to disclose or fairly suggest the above-noted drawbacks and deficiencies of Bennett. Therefore, it is respectfully submitted that Bennett and Khan, alone or in combination, fail to disclose or fairly suggest the features of claim 1 concerning *wherein an eavesdropping is detected by said recipient measuring a change in a quantum-mechanical probability distribution of said difference signal, which is produced by the eavesdropping operation.*

The Examiner states in terms 2 of page 11 of the Action that Kahn discloses that:  
“Wherein said phase difference is assigned to bit 0 or bit 1 by comparing said difference signal with threshold values which are determined from a quantum-mechanical probability distribution of said difference signals obtained from a set of said phase differences assigned bit 0 or bit 1 (col.2, line 61 – col.3, line 6)”.

However, according to col.2, line 61 – col.3, line 6, it is described that:

“A binary “1” may be represented by a phase shift of positive 90 degrees while a “0” may be represented by a phase shift of negative 90 degrees. The local oscillator is in phase with one set of symbols (eg., the “1”s) and out of phase with the other set (eg., the “0”s) as shown in Fig.2.”

In view of the above disclosure, it is clear that Kahn discloses how information is encoded in phase shifts and how the local oscillator is related to the symbols in phase, but does not disclose how information is decoded.

Moreover, it is described that the intensity of signal light of Kahn is 295 pW (col.6, line 39 of Kahn). Since the intensity of signal light of Kahn is far larger than the intensity of signal light that is so weak that quantum mechanical state is detectable, the quantum mechanical state of the signal light of Kahn can not be detectable, therefore it is meaningless to compare the output signal of Kahn with threshold values which are determined from a quantum-mechanical probability distribution, for the purpose of detecting an eavesdropping by detecting a change of a quantum mechanical distribution which can be only derived from a plurality of signals whose intensity is so weak that quantum mechanical state is detectable.

Therefore, it is respectfully submitted that Kahn fails to disclose “Wherein said phase difference is assigned to bit 0 or bit 1 by comparing said difference signal with threshold values which are determined from a quantum-mechanical probability distribution of said difference signals obtained from a set of said phase differences assigned bit 0 or bit 1.”

The Examiner states at lines 6-8 of page 11 of the Action that:

"At the time applicant's invention was made, it would have been obvious to one of ordinary skill in the art to modify Bennett's invention according to the limitations recited in claim 1 in light of Kahn's teachings. One of ordinary skill would have been motivated to do so because Bennet discloses that the choice of a photodetector is an important consideration (col.8, lines 45-46)---".

Applicant respectfully disagrees with the statement, because, as the Examiner noted, Bennett discloses that the choice of a photodiode is an important design consideration (col 8, lines 45-46), however he also states that "photodetector should be able to count single photons" in the next line (col 8, lines 46-47). This statement clearly shows that Bennett fails to disclose or fairly suggest to use a detector that can not count single photons, which is essential in the present invention. A homodyne detector can not count single photons, but measures a quadrature amplitude of the signal light, which is a real numerical value varying continuously. Therefore, it is clear that it was not obvious to one of ordinary skill to modify Bennett's invention in light of Kahn's teaching.

In view of the aforementioned amendments and accompanying remarks, Applicant submits that that the claims, as herein amended, are in condition for allowance. Applicant requests such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned attorney to arrange for an interview to expedite the disposition of this case.

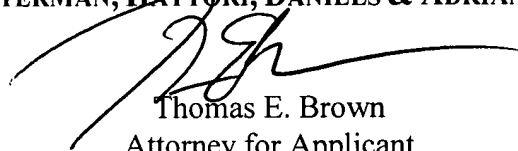


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If this paper is not timely filed, Applicant respectfully petitions for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

**WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP**

A handwritten signature in black ink, appearing to read 'TEB', is written over the firm name.

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